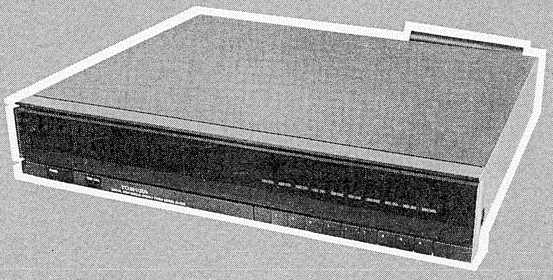
SERVICE DATA
FILE NO. 170-166

TOSHIBA

DIGITAL SYNTHESIZER TUNER

ST-S90



SPECIFICATIONS

■ General Data

Power Supply: 220V ∿, 50 Hz for Europe; 240V ∿, 50 Hz for United Kingdom and Australia
Power Consumption: 20W
Dimensions: 420(W) x 84(H) x 414(D) mm
Weight: 4.4 kg

■ Tuner

Microcomputer-controlled frequency synthesizer tuning
Frequency Range: FM: 87.50 – 108.00 MHz, 411 channels
AM: 522 – 1710 kHz, 133 channels
Memory: 20 channels total
Functions: Manual scanning (FM 50 kHz steps AM 9 kHz steps)

■ FM Tuner Section

Sensitivity (IHF): 1.0 μV (11.2 dBf)
Harmonic Distortion: 1 kHz MONO, 0.08% (WIDE)
S/N Ratio: MONO: 83 dB
STEREO: 77 dB
Frequency Response: ±1.0 dB, 30 Hz to 15 kHz
Selectivity: 75 dB (±250 kHz) (NARROW)
Image Rejection: 75 dB
IF Rejection: 88 dB
Capture Ratio: 1.5 dB
Spurious Response: 95 dB
AM Suppression: 58 dB
Stereo Separation: 45 dB (at 1 kHz)

■ AM Tuner Section

Reception Frequency: 522 – 1710 kHz (9 kHz steps)
Sensitivity: 220 μV/m
Selectivity: 30 dB
Image Rejection: 60 dB
S/N Ratio: 58 dB

■ Timer Section

Timer Display: 24-hour clock
Timer Type: 24-hour clock, ON and OFF setting capacity
Time Setting Interval: From 1 min. to 23 hrs. 59 min.
Timer Memory Back-up (Battery Life): 2 weeks (continuous)

Specifications are subject to change without notice.

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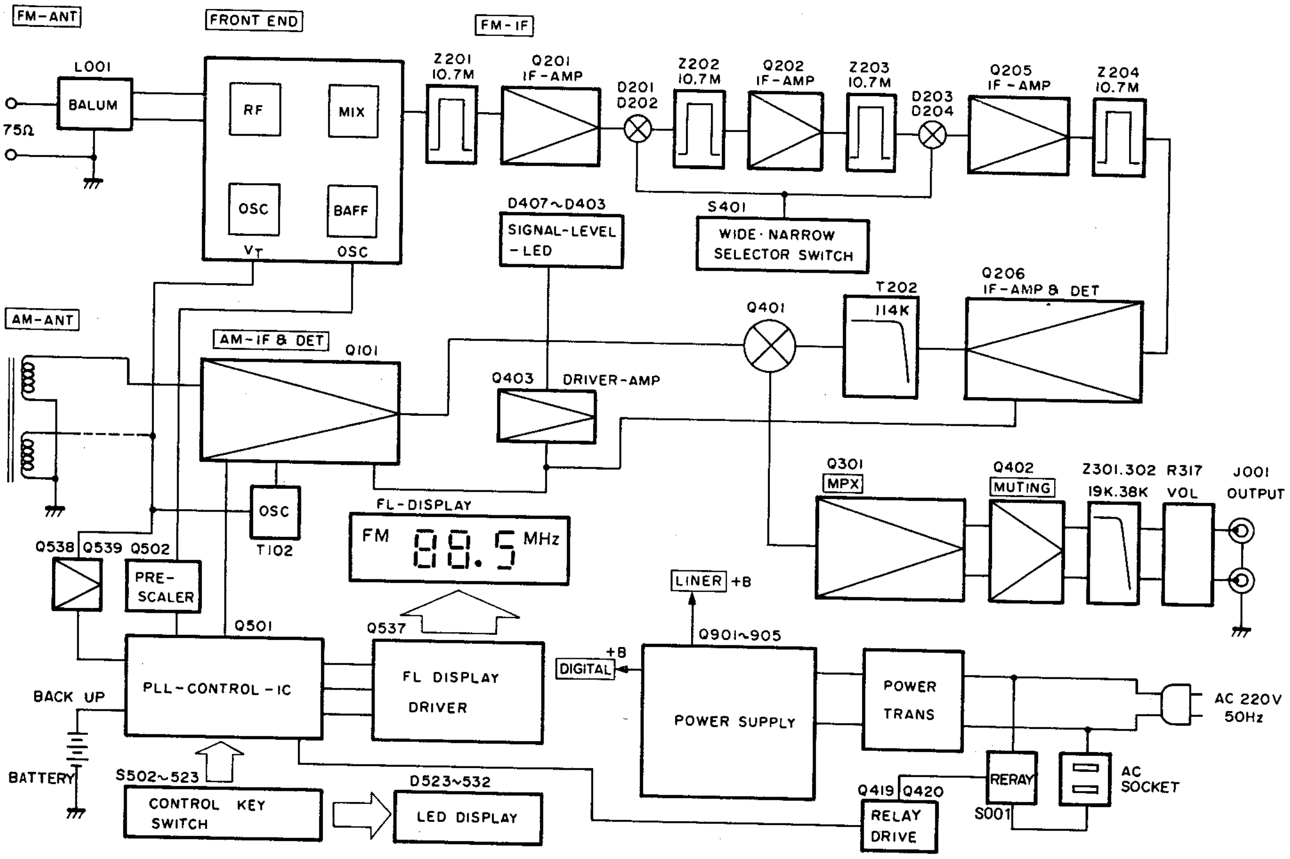
CONTENTS

1. BLOCK DIAGRAM 2
2. OPERATING CONTROL .... 3 to 7
3. DISASSEMBLY INSTRUCTIONS 8
4. ADJUSTMENTS .... 9 to 12
5. ELECTRICAL PARTS LOCATIONS .... 13 to 14
6. SCHEMATIC DIAGRAM 15
7. EXPLODED VIEW CABINET 16
8. CABINET PARTS LIST 17
9. PARTS LIST .... 18 to 22

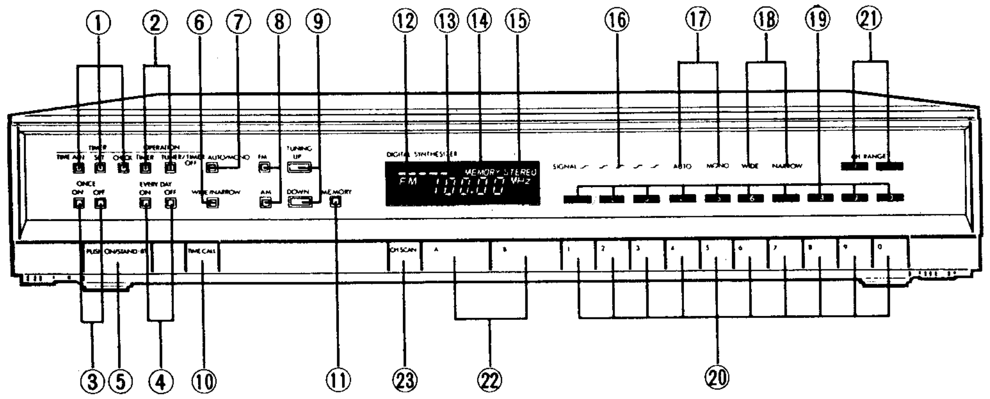
1. BLOCK DIAGRAM



FM-ANT
FRONT END
FM-IF
L001
BALUM
75Ω
RF
MIX
OSC
BAFF
VT
OSC
Z201
10.7M
Q201
IF-AMP
D201
D202
Z202
10.7M
Q202
IF-AMP
Z203
10.7M
D203
D204
Q205
IF-AMP
Z204
10.7M
D407~D403
SIGNAL-LEVEL
-LED
S401
WIDE·NARROW
SELECTOR SWITCH
Q206
IF-AMP & DET
T202
114K
Q401
AM-ANT
AM-IF & DET
Q101
Q403
DRIVER-AMP
OSC
T102
FL-DISPLAY
FM
88.5
MHz
Q301
MPX
Q402
MUTING
Z301.302
19K.38K
R317
VOL
J001
OUTPUT
Q538
Q539
Q502
PRE-
SCALER
Q501
Q537
LINER
+B
Q901~905
+B
DIGITAL
BACK UP
PLL-CONTROL-IC
FL DISPLAY
DRIVER
POWER SUPPLY
POWER
TRANS
AC 220V
50Hz
BATTERY
S502~523
CONTROL KEY
SWITCH
D523~532
LED DISPLAY
Q419
Q420
RELAY
DRIVE
RERAY
S001
AC
SOCKET

Figure 1

2. OPERATING CONTROLS



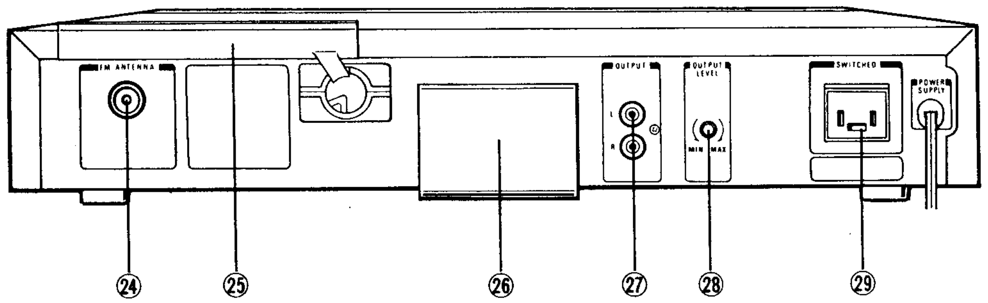


Figure 2

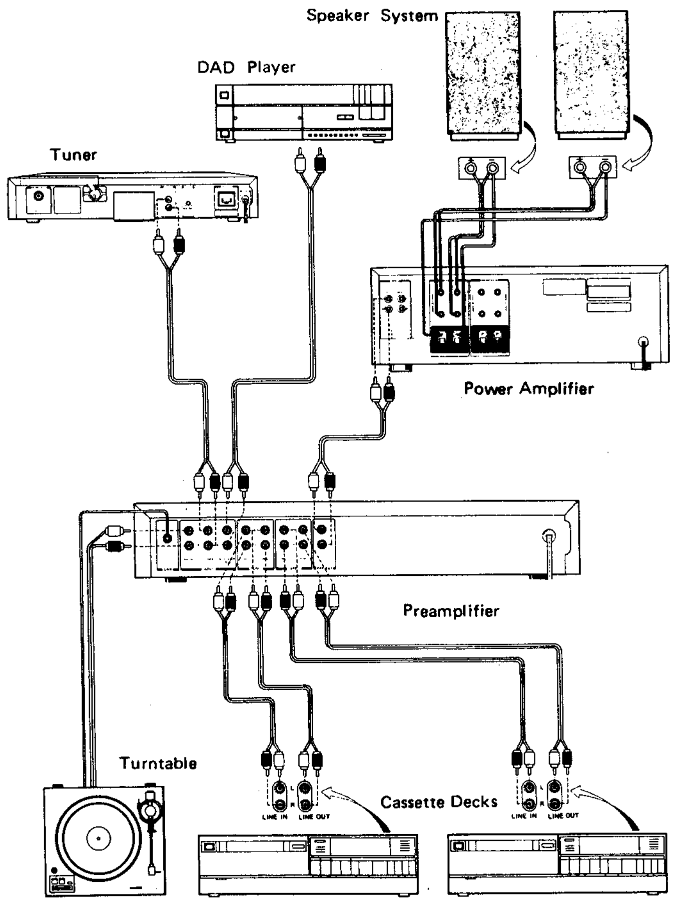


Figure 3

REAR PANEL FACILITIES CONNECTIONS

(Refer to Fig. 2)

① **TIMER Buttons**
TIME ADJ: Use this button to set the timer to the present time. Details may be found in the instructions for "Time Adjust"
SET: This button is used for programming stations to play at a certain time. Details may be found in the instructions entitled "Programming the Timer"
CHECK: Press this button to confirm the time and station frequency preset in the timer. Details may be found in the instructions entitled "Checking Program Contents"

② **OPERATION Buttons**
TIMER: Press this button to turn the power to the component plugged into the tuner rear panel AC outlet ON and OFF in accordance with the timer setting.
TUNER/TIMER OFF: Press this button in conjunction with the ON or STAND-BY FUNCTION switch to turn the power to the component plugged into the tuner rear panel AC outlet ON/OFF regardless of the timer setting.

③ **ONCE ON-OFF Buttons**
Use this button to program the timer to tune in a station once at a specified time, then turn the power OFF. Details may be found in the instructions entitled "Programming the Timer"

④ **EVERYDAY ON-OFF Buttons**
This button is used to program the timer to tune in a station daily at a specified time, then turn the power OFF. Details may be found in the instructions entitled "Programming the Timer"

⑤ **Function Switch**
ON position: Turns on power to the component plugged into the rear panel AC outlet. The tuned frequency will appear in the frequency display ⑬.
STAND-BY position: Turns off power to the component plugged into the rear panel AC outlet. The frequency display will switch to the present time. (If TIME ADJ has not been adjusted, a colon (:) will appear in the display.)

⑥ **WIDE/NARROW Button**
When tuned to an FM station, this switch functions to widen or narrow the passband relative to the center frequency of the signal.
WIDE: In areas where the signal strength is relatively strong, the WIDE setting will produce better frequency response, and distortion will remain low. From the standpoint of tone quality, this is the better setting.
NARROW: In an area where the dial is crowded, the NARROW setting will increase selectivity, reducing the amount of interference from adjacent channels. Reception will be clear, but frequency response will be more narrow.

⑦ **AUTO/MONO Button**
(Operates only when FM-AM switch is set to FM.)
AUTO: This setting allows the tuner to automatically select FM stereo, monaural, or muting. Muting eliminates between station noise.
MONO: The MONO setting provides monaural reception of all broadcast signals and deactivates the muting function. In areas where the signal is weak, or for reception of distant stations, use this setting for better results.

⑧ **FM—AM Buttons**
Use to select the FM or AM broadcast band.

⑨ **UP-DOWN TUNING Buttons**
Use these buttons to tune the desired station frequency. Press UP to move to a higher frequency and DOWN for lower frequencies. Frequency change is continuous when UP or DOWN is held down; simply release the button when you approach the desired frequency. Pressing either button once results in a 0.05 MHz change on the FM band and a 9 kHz change on the AM band.

⑩ **TIME CALL Button**
When the frequency display is indicating a frequency, press this button to read the present time. The time display will last for approximately 5 seconds, after which it will return to the frequency display.

⑪ **MEMORY Button**
To store the frequency of a radio station in the memory, first tune to the frequency, then press this button. The memory indicator ⑭ will light indicating that the memory will accept the frequency. Note however, that this status will remain for only about 5 seconds.

⑫ **FM/AM Indicator**
Indicates whether the station presently tuned is FM or AM.

⑬ **Frequency Display**
Indicates the tuned frequency or the present and preset times.

⑭ **MEMORY Indicator**
This indicator will light when the memory button is pressed, signifying that the tuned frequency may be stored in memory at this time. After the indicator goes out, memory is no longer "open" and the memory button must be pressed again, followed by the channel selector and preset tuning buttons.

⑮ **FM Stereo Indicator Lamp**
Indicates that FM reception is in stereo.

⑯ **Signal Strength**
This row of lamps lights to indicate the strength of the reception signal. If fewer than four of five lamps are illuminated when tuned to a local station, check antenna connections and direction.

⑰ **Mode Indicators (AUTO/MONO)**
These indicators show the status of the AUTO/MONO button. When the button is in the out position (AUTO), the AUTO lamp is illuminated; when in the down position (MONO), MONO is illuminated.

⑱ **WIDE/NARROW Indicators (WIDE/NARROW)**
These indicators show the status of the FM bandwidth selector. When the button is in the out position (WIDE), the WIDE lamp is illuminated; when in the down position (NARROW), NARROW is illuminated.

⑲ **Channel Indicators**
Indicates which channel has been selected by the preset tuning buttons.

⑳ **Preset Tuning Buttons (1 — 0)**
While the memory indicator ⑭ is illuminated, first press one of the channel selector buttons then press one of these buttons. The station frequency will then be stored in the memory. To recall that frequency, press the appropriate channel selector button followed by the same preset tuning button. Each preset tuning button is marked with an indicator lamp. (Preset tuning buttons also used for setting the timer.)

㉑ **Channel Selector Indicators**
Indicates which channel selector has been pressed.

㉒ **Channel Selector buttons (A, B)**
Up to 20 stations can be stored in the memory using the channel selectors and the preset tuning buttons. For example, after selector A is pressed, one station can be set using each preset tuning button. 10 more stations can be set using the same preset tuning buttons after selector B has been pressed. To recall one of the preset stations, press the appropriate selector (A or B), then press the preset tuning button. (A recommendation to make operations easier is the you store your most often used stations with selector A.)

㉓ **Channel Scan button**
Pressing this button automatically scans the full frequency band, pausing approximately 5 seconds at each station. Pressing this button again to stop scan. Pressing one of the preset tuning buttons ⑳ also stops scan, and immediately tunes to the frequency of the preset station. This function is useful for sampling programs, or checking station frequencies.

REAR PANEL FACILITIES

㉔ Antenna Terminal (FM ANTENNA)
Used to connect the FM antenna.

㉕ Ferrite Bar Antenna
Used for AM reception. Adjust position for strongest signal pickup.

㉖ Battery Compartment
Holds the three size AA (UM-3) backup batteries.

㉗ Output Terminal (OUTPUT)
Connect via cable to the TUNER input on the amplifier.

㉘ Output Level
Volume control used to adjust output level. Turn to the right to increase level.

㉙ AC Outlet (SWITCHED)
Permits another audio component to be connected to the ST-S90.

CONNECTIONS

(Refer to Fig. 3)

(1) Terminals are provided for 75-ohm FM antenna only. For a 300-ohm antenna, use a matching adapter.
(2) For AM reception, adjust the bar antenna to the position where the signal strength indicator shows maximum signal strength.
(3) Connect the OUTPUT terminals of the tuner to the TUNER terminals of an amplifier, making sure that the left (L) and right (R) channels are not reversed.

BATTERY INSTALLATION

(Refer to Fig. 4)

Open the battery cover and, observing correct (+) and (–) pole polarity, load the three size AA (UM-3) batteries. Replace battery cover.

Note:
1. The battery backup will ensure that memory contents are held in case power should be lost or if the unit is unplugged for a long time.
2. Battery life is approximately 1 year when the unit is unplugged from the wall socket. Replace worn-out batteries immediately.

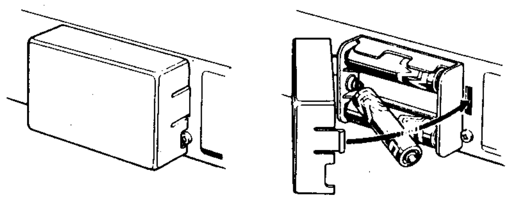


Figure 4

TUNER OPERATION

First press the FM or AM selector button.

■ **Tuning**
Press the UP or DOWN tuning button and hold it down until the frequency display approaches the desired station. Release the button, then tap it lightly to tune the precise frequency.

■ **Preset Tuning**
One of the major features of the ST-S90 is its ability to store up to 20 stations from any of the two bands for instant recall. To store a station in memory:
(1) Check the official broadcast frequency of the station, or simply tune to it as noted above.
(2) After confirming that the station is accurately tuned, press the memory button. The memory indicator lamp will light for about 5 seconds, during which time the memory is "open" to store the frequency.
(3) While the memory indicator is illuminated, press the A or B channel selector button, followed immediately by pressing one of the preset tuning buttons. If the indicator goes out before this sequence can be completed, start over by pressing the memory button again.
(4) Repeat this procedure for every staton to be stored in memory.
(5) To recall one of the preset stations, press the channel selector and the preset tuning button corresponding to that station.

Note 1: In certain countries (e.g., West Germany), allocated frequency spacing is 50 kHz rather than the normal 100 kHz.

Note 2: A small electric current is used to hold memory contents even when the function switch is in the standby position. When the unit is not going to be used over a long period of time, it should be unplugged from the wall socket. Note however, that if backup batteries are not used and the power remains off for over 24 hours, memory contents are lost, and the preset stations will have to be stored again. Consequently, always make sure that the battery compartment holds good batteries before unplugging the tuner.

TIMER OPERATIONS

Time Adjust

1 Plug the power cord into a regular AC wall socket.
- A colon (:) will appear in the frequency display, indicating that the time has not yet been adjusted in the timer unit.

2 Press the TIME ADJ button ①.
3 The present time is set using the preset tuning buttons 1 – 0.
- The time is indicated using the 24-hour clock method.

Example 1: To set 8:15 AM in the clock.

(Preset Tuning Button)	(Display)
(a) Press 0.	:
(b) Press 8.	:
(c) Press 1.	:
(d) Press 5.	8:15

Example 2: To set 8:15 PM in the clock.

(a) Press 2.	:
(b) Press 0.	:
(c) Press 1.	:
(d) Press 5.	20:15

- * The display will not function until the 4th digit (min.) is set.
- * While the preset tuning buttons are pressed to set the time digits, their indicators light orange, one after the other.
- * If a mistake is made while setting the time, go ahead and set all four digits, then start over replacing them with the correct digits.

To start the clock.
- * Use a time tone (telephone, radio, etc.), and press the TUNER operation switch ②.
- * The clock will start running, indicated by a blinking colon (:).

Programming the Timer

■ **ONCE ON – OFF time setting**
This program is designed for programs that you would like to hear only one time and is commonly used for unattended recording. The following instructions tell you how to program the timer to turn the power ON and OFF. The description will assume that the program runs from 2:15 PM to 3:45 PM, and that the FM station is stored at channel selector A, preset tuning button "A1".

1. Press the TIMER SET button ①.

   * The frequency display will now show the present time.

2. Set the ON time according to the following instructions.

   (a) Press the ONCE ON–OFF "ON" button. This will change the freqency display to a colon (:).

	:
(b) Press 1.	:
(c) Press 4.	:
(d) Press 1.	:
(e) Press 5.	:
(f) Press A Press A followed by 1. (Preset channel "A1").	14:15

*When the final button 1 is pressed, the frequency display will change to indicate the program start time. This display will last for approximately 5 sec., followed by a return to the present time. (During this interval, preset channel indicator 1 glows orange.)

3 Set the OFF time according to the following instructions.
   (a) Press the ONCE ON – OFF "OFF" button. This will change the frequency display to a colon (:), and preset channel indicator 1 will glow orange.

	:
(b) Press 1.	:
(c) Press 5.	:
(d) Press 4.	:
(e) Press 5.	15:45

- If you have made a mistake in the ON time setting, start over by pressing the ON button again and entering the correct time and preset channel. If a mistake was made in the OFF time setting, go ahead and finish entering the four time digits, then press the OFF button and reenter the correct digits.

4. Press the TIMER operation switch ②. This will change the frequency display to indicate the present time, accompanied by a blinking colon (:).
5. Set the function switch to STAND-BY.
6. This completes the ONCE ON – OFF program.

■ **EVERYDAY ON – OFF time setting**
This program is designed for programs that you would like to hear at the same time every day, and is commonly used as a substitute for a morning alarm. The following instructions tell you how to program the timer to turn the power ON and OFF. The description will assume that the program runs from 7:10 AM to 8:15 AM and that the AM station is stored at channel "B2".

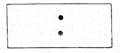
1. Press the TIMER SET button ①.
   * The frequency display will now show the present time.
2 Set the ON time according to the following instructions.
   (a) Press the EVERYDAY ON – OFF "ON" button. This will change the frequency display to a colon (:).

	:
(b) Press 0.	:
(c) Press 7.	:
(d) Press 1.	:
(e) Press 0.	:
(f) Press B, followed by 2. (Preset channel "B2")	7:10

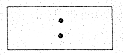
3 Set the OFF time according to the following instructions.
   (a) Press the EVERYDAY ON – OFF "OFF" button. This will change the frequency display to a colon (:) and preset channel indicator 2 will glow orange.

	:

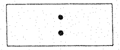
(b) Press 0.



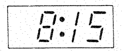
(c) Press 8.



(d) Press 1.



(e) Press 5.



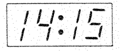
- If you have made a mistake in the ON time setting, start over by pressing the ON button again and entering the correct time and preset channel. If a mistake was made in the OFF time setting, press the OFF button and reenter the correct digits.

4. Press the TIMER operation button ②. This will change the frequency display to indicate the present time, accompanied by a blinking colon (:).
5. Set the function switch to STAND-BY.
6. This completes the EVERYDAY ON – OFF program.

Checking Program Contents

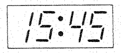
Program contents may be checked by simply pressing the CHECK timer button ①. The following insturctions show you the operation and "reading" procedure.

1 Press the TIMER CHECK button.
2 Press the ONCE ON – OFF "ON" button.



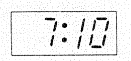
- The frequency display will indicate the ONCE ON – OFF start time, and preset channel indicator 1 will glow orange.

3 Press the ONCE ON – OFF "OFF" button.



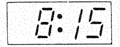
- The frequency display will indicate the ONCE ON – OFF stop time, and preset channel indicator 1 will glow orange.

4 Press the EVERYDAY ON – OFF "ON" button.



- The frequency display will indicate the EVERYDAY ON – OFF start time, and preset channel indicator 2 will glow orange.

5 Press the EVERYDAY ON – OFF "OFF" button.



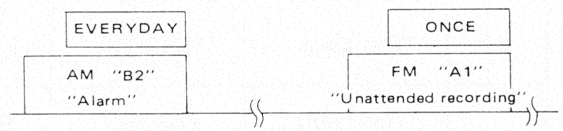
- The frequency display will indicate the EVERYDAY ON OFF stop time, and preset channel indicator 2 will glow orange.

6 Press the TIMER operation switch ②.

Timer Applications

The timer functions of the ST-S90 can basically be divided into two categories; ONCE ON – OFF, used for programs that you would like to hear or record unattended just one time, and EVERYDAY ON – OFF, used for programs you listen to daily or as a substitute for an alram clock.

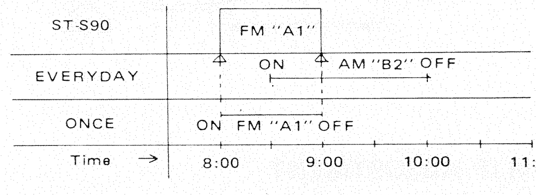
- **Using both functions together:**
  1 Set the EVERYDAY ON – OFF timer to come ON at 7:10 and go OFF at 8:15.
  2 Set the ONCE ON – OFF timer to come ON at 14:15 and go OFF at 15:45.



- When set in the above sequence, if the time setting of EVERYDAY and ONCE overlaps, the first setting will have priority and the second setting will not come ON. Note however, that pressing the CHECK button to check program contents can change these priorities.

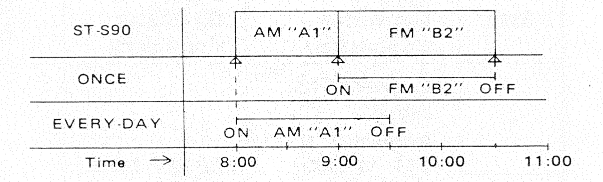
- When the ONCE ON – OFF and EVERYDAY ON OFF time setting overlaps.

1. If the time setting for ONCE "OFF" protrudes into the time setting for EVERYDAY ON – OFF (or when ONCE goes "OFF" at the same time EVERYDAY comes "ON").



- The FM "A1" program between 8:00 and 9:00 will be heard, but AM "B2" will not however, AM "12" will be heard the next day between 8:30 and 10:00.

2. If the time setting for ONCE "ON" protrudes into the time setting for EVERYDAY ON – OFF (or when EVERYDAY goes "OFF" at the same time ONCE comes "ON").



- The AM "A1" program will be heard between 8:00 and 9:00, followed by the FM "B2" program between 9:00 and 10:30. The AM "A1" program will then be heard the next day between 8:00 and 9:30.

3. DISASSEMBLY INSTRUCTIONS

TOP COVER REMOVAL

1. Remove five screws Ⓐ , Ⓑ and Ⓒ (3φ x 8mm), then the top cover can be removed from the unit.

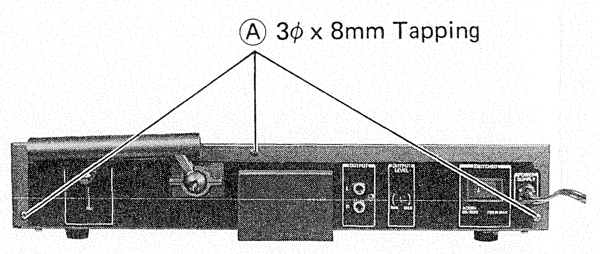


Figure 5

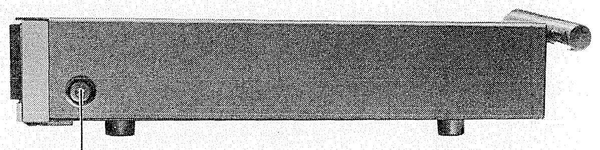


Figure 6

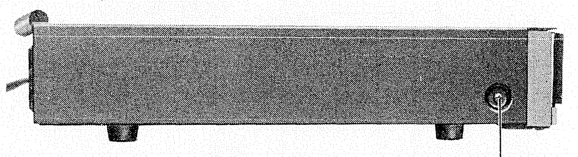


Figure 7

BOTTOM PLATE REMOVAL

1. Remove six screws Ⓓ , then the Bottom Plate can be removed from the unit.

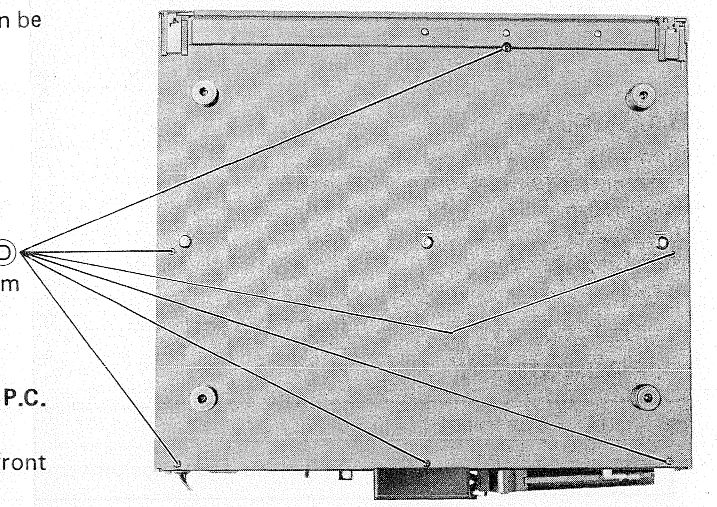


Figure 8

FRONT PANEL ASSEMBLY REMOVAL (with P.C. Board)

1. Remove five screws Ⓔ , Ⓕ and Ⓖ , then the front panel assembly can be removed from the unit.

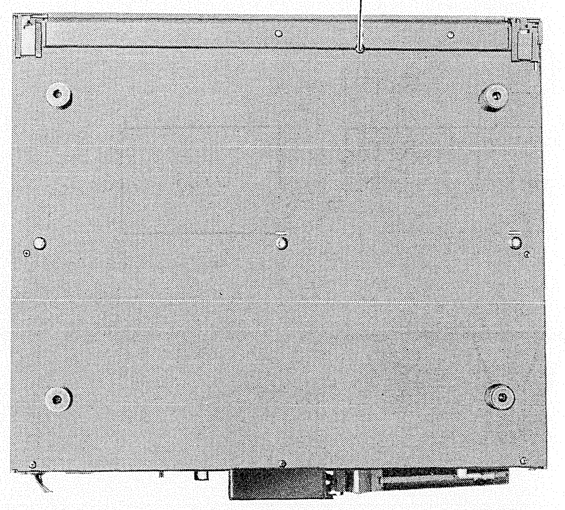


Figure 9

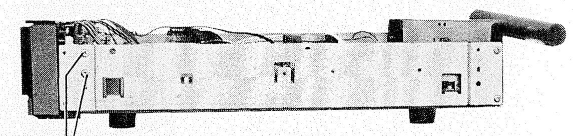


Figure 10

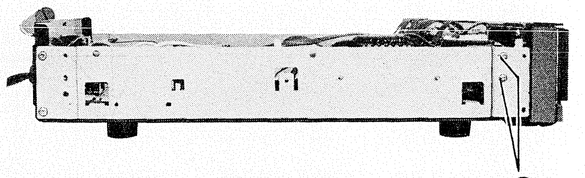


Figure 11

4. ADJUSTMENTS

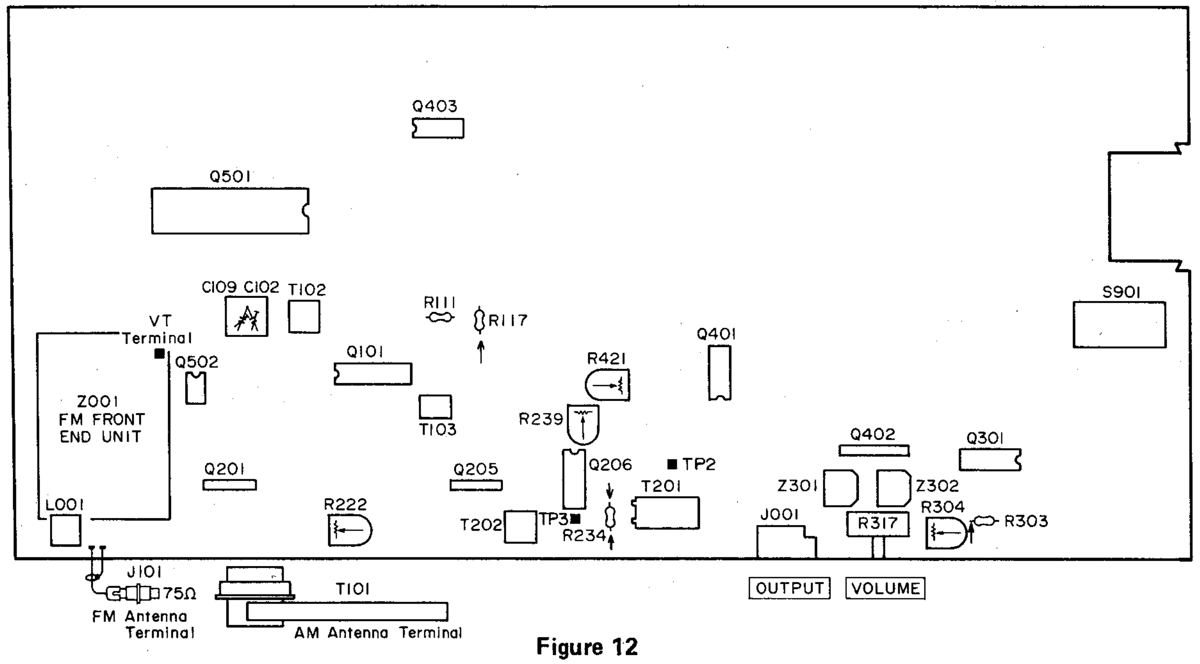

Q403
Q501
C109 C102 T102
R111
R117
VT
Terminal
Q502
Q101
Q401
R421
S901
Z001
FM FRONT
END UNIT
T103
R239
Q402
Q301
Q201
Q205
Q206
TP2
T201
Z301
Z302
L001
R222
T202
TP3
R234
J001
R317
R304
R303
J101
75Ω
FM Antenna
Terminal
T101
AM Antenna Terminal
OUTPUT
VOLUME

Figure 12

AM ADJUSTMENT

Test equipments/Tools required

1. Signal generator (with frequency counter)
2. Sweep generator
3. Test loop Aerial
4. Adjusting screwdriver
5. Oscilloscope

TABLE 1 IF ADJUSTMENT

Step	Adjustment	Remarks
IF Response	T103	Adjusts the scope pattern with specified marker (450 kHz) as illustrated in Fig. 13.

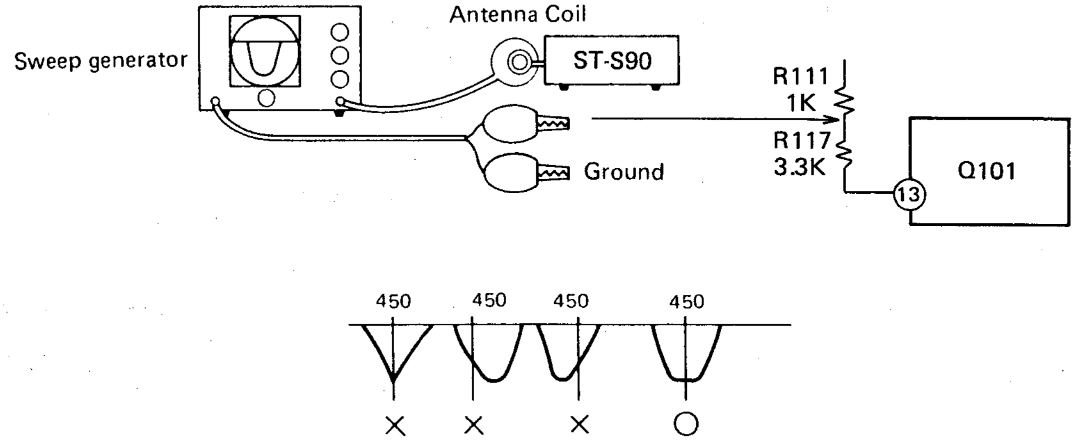

Sweep generator
Antenna Coil
ST-S90
R111
1K
R117
3.3K
Ground
13
Q101
450
450
450
450
×
×
×
○

Figure 13

AM ADJUSTMENT (VT ADJUSTMENT)

1. Set function switch to AM.
2. Set signal generator frequency as listed in TABLE 2 AM ADJUSTMENT CHART.
3. Proceed as outlined in the TABLE 2 AM ADJUSTMENT CHART.

TABLE 2 AM ADJUSTMENT CHART

Step	Signal Generator Connection	Signal Generator Frequency	Display Frequency	Connection	Adjustment	Remarks
VT	Test Loop	1,710 kHz	1,710 kHz	DC Voltmeter across VT Terminal	C109	25V + 0V –0.5V
1	Test Loop	603 kHz	603 kHz	VTVM across Output	T101	Adjust for Maximum
2	Test Loop	1,404 kHz	1,404 kHz	VTVM across Output	Trim. C102	Adjust for Maximum
3	Repeat above steps until no further improvement is noticed.					

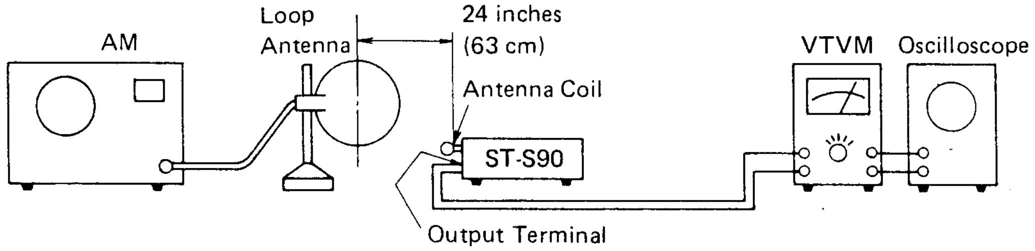
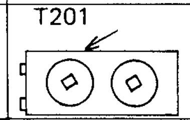
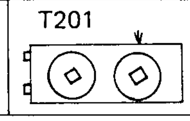

AM
Loop
Antenna
24 inches
(63 cm)
Antenna Coil
ST-S90
Output Terminal
VTVM
Oscilloscope

Figure 14

FM IF ADJUSTMENT

1. Set function switch to FM.
2. Set signal generator frequency as listed in TABLE 3 FM IF ADJUSTMENT CHART.
3. Proceed as outlined in the TABLE 3 FM IF ADJUSTMENT CHART.

TABLE 3 FM-IF ADJUSTMENT CHART

Step	Signal Generator Connection	Signal Generator Frequency	Display Frequency	VTVM or Oscilloscope Connection	Adjustment	Remarks
1	Connect FM signal generator to FM Antenna Terminal. Connect the modulator to signal generator.	98.000 MHz 60 dB	98 MHz	Connect VTVM to R234	T201 	Adjust for Test Point FM-IF Voltage 0V
2				VTVM across Output	T201 	Adjust for Minimum Distortion
3	Repeat above steps until no further improvement is noticed.					

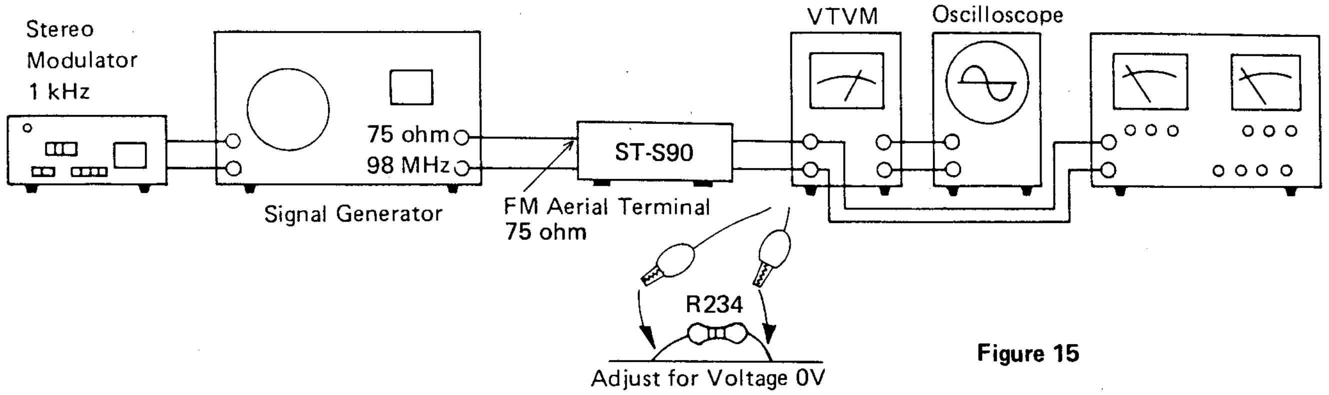

Stereo
Modulator
1 kHz
75 ohm
98 MHz
Signal Generator
ST-S90
FM Aerial Terminal
75 ohm
VTVM
Oscilloscope
R234
Adjust for Voltage 0V

Figure 15

FM MPX ADJUSTMENT

	Input	VTVM or Oscilloscope Connection	Adjustment	Remarks
Free-running Frequency Adjustment	No Modulation	R304	R304	Adjust for 76 kHz

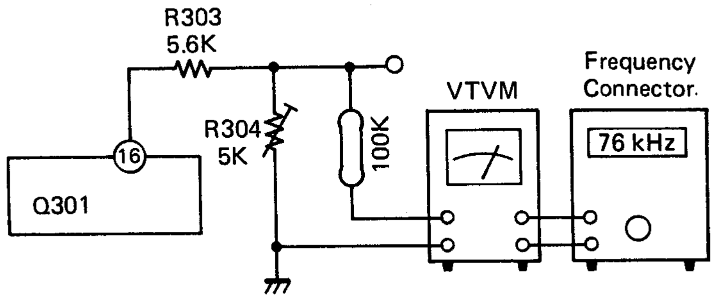

R303
5.6K
R304
5K
100K
16
Q301
VTVM
Frequency Connector.
76 kHz

Figure 16

MUTING ADJUSTMENT

Signal Generator Connection	Signal Generator Frequency	Display Frequency	Connection	Adjustment	Remarks
Connect signal generator to FM Antenna Terminal	98.000 MHz 20 ± 3 dB	98.0 MHz	VTVM to Output	R239	Signal ON. AUTO-STOP-LEVEL-VR ⇒ DX

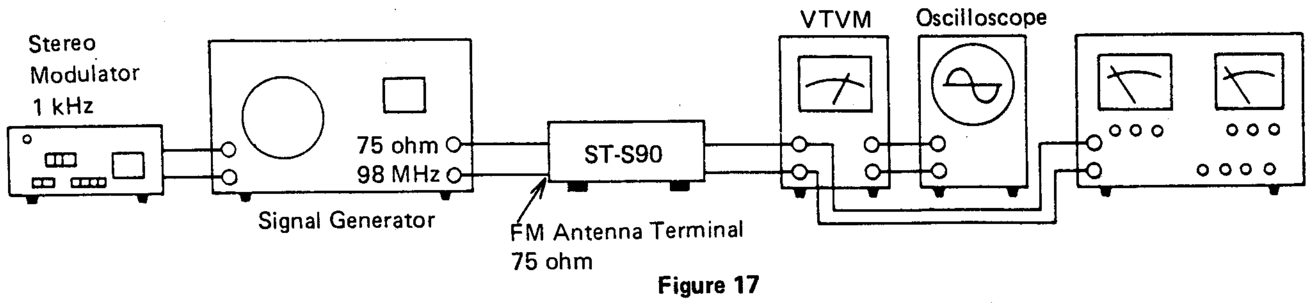

Stereo Modulator
1 kHz
75 ohm
98 MHz
Signal Generator
ST-S90
FM Antenna Terminal
75 ohm
VTVM
Oscilloscope

Figure 17

TRACKING ADJUSTMENT (VT CONFIRM)

Test Equipments/Tools required

1. Signal Generator (with Frequency Counter)
2. Oscilloscope
3. DC Voltmator
4. VTVM

(1) Function Switch FM Position. Mode Switch MONO Position.

Band	Step	Signal Generator Frequency	Display Frequency	Connection		Adjustment	Remarks
				Input	Output		
FM	1	88 MHz (50 dB)	88 MHz	–	Connect DC Voltmeter to VT and Ground	–	Confirm 2.85V
	2	108 MHz (50 dB)	108 MHz			–	Confirm 21V

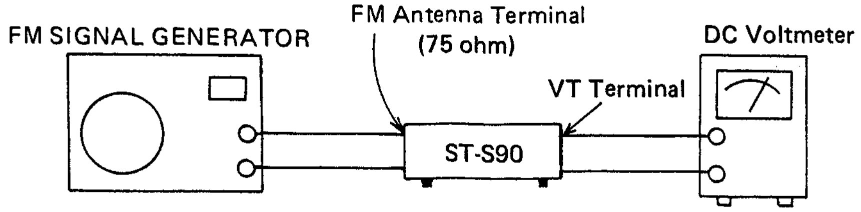

FM SIGNAL GENERATOR
FM Antenna Terminal
(75 ohm)
DC Voltmeter
VT Terminal
ST-S90

Figure 18

SIGNAL-LED ADJUSTMENT

Band	Signal Generator Frequency	Display Frequency	Connection	Adjustment	Remarks
FM	98 MHz (60 dB)	98 MHz	FM Antenna	NARROW R222 WIDE R421	5-LED Illuminate

DISTORTION ADJUSTMENT

(1) Memorize 98 MHz for channel 5.

FM	98 MHz (60 dB)	Channel 5	98 MHz	FM Antenna Terminal	OUTPUT Terminal	T201	Adjust for minimum distortion (0.3%) and from 400mV to 500mV VTVM. Adjust voltage between TP-2 and TP-3 for 0V.

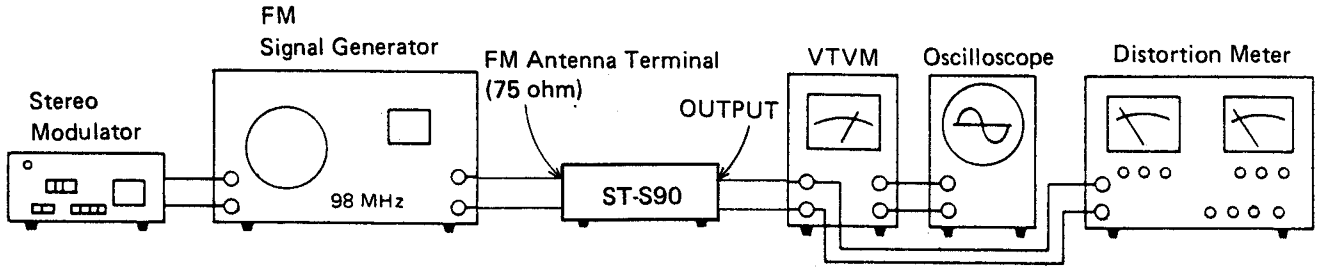
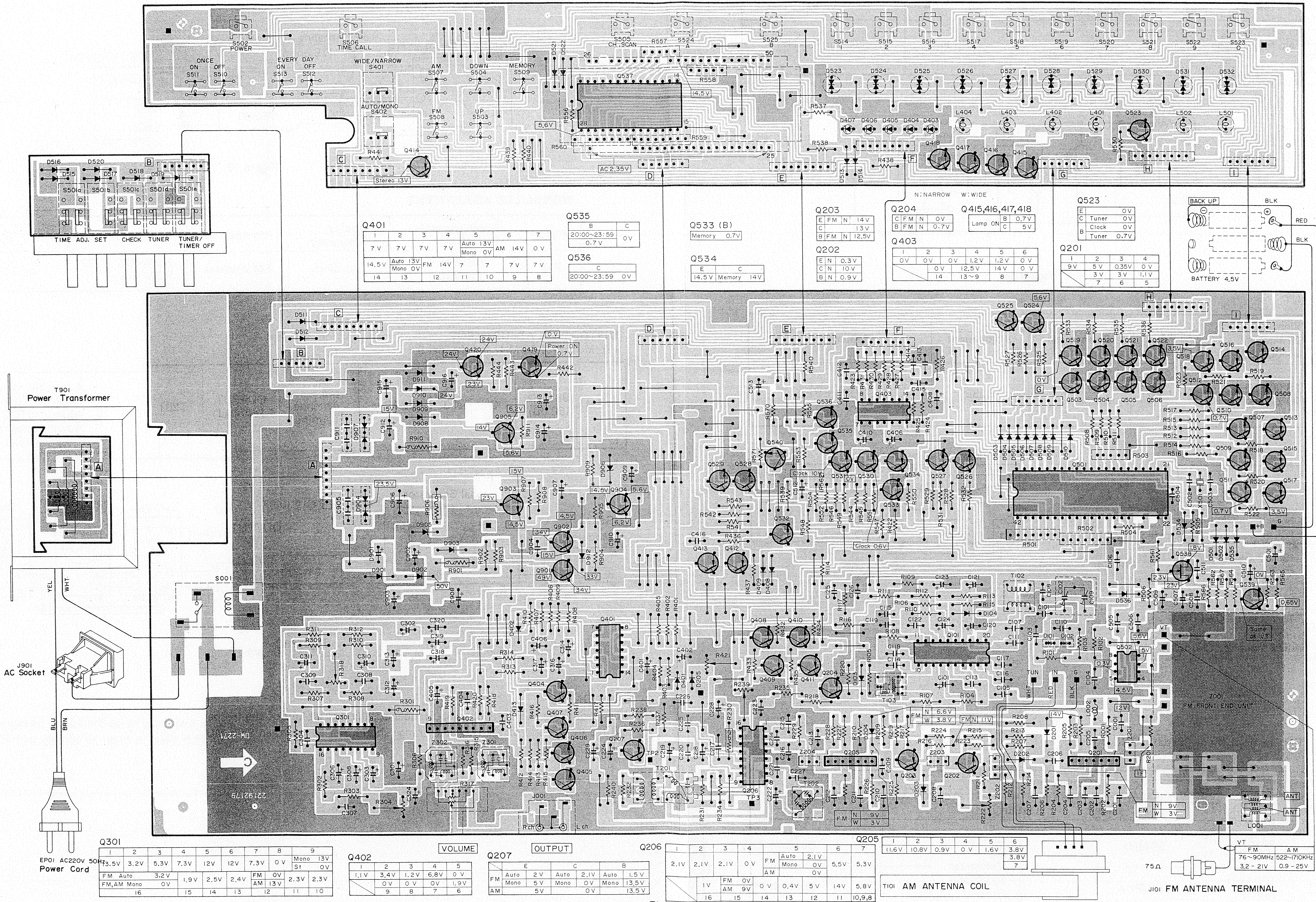

FM
Signal Generator
Stereo Modulator
98 MHz
FM Antenna Terminal
(75 ohm)
OUTPUT
ST-S90
VTVM
Oscilloscope
Distortion Meter

Figure 19

CAUTION:

When realigning the FM Receiving Frequency, the highest end of the frequency range should not be more than 108.0 MHz and the lowest end of the frequency range should not be less than 87.5 MHz, in order to comply with FTZ regulations in West Germany.

5. ELECTRICAL PARTS LOCATIONS


S502 POWER
S506 TIME CALL
ONCE ON OFF S511 S510
EVERY DAY ON OFF S513 S512
WIDE/NARROW S401
AUTO/MONO S402
AM S507
FM S508
DOWN S504
UP S503
MEMORY S509
S505 CH-SCAN
S524 A
S525 B
S514 1
S515 2
S516 3
S517 4
S518 5
S519 6
S520 7
S521 8
S522 9
S523 0
Q537
Stereo 13V
AC 2.35V
5.6V
4.5V
TIME ADJ. SET
CHECK
TUNER
TUNER/ TIMER OFF
S501a S501b S501c S501d S501e
N: NARROW W: WIDE
BACK UP
BLK
RED
BLK
BATTERY 4.5V
T901 Power Transformer
YEL
WHT
S001
J901 AC Socket
BLU
BRN
EP01 AC220V 50Hz
Power Cord
Q501
Z001 FM FRONT END UNIT
VOLUME
OUTPUT
Rch
Lch
J001
FM N 9V W 3V
ANT
L001
VT
75Ω
T101 AM ANTENNA COIL
J101 FM ANTENNA TERMINAL

Q401

1	2	3	4	5	6	7
7 V	7 V	7 V	7 V	Auto 13V Mono 0V	AM 14V	0 V
14.5 V	Auto 13V Mono 0V	FM 14V	7	7	7 V	7 V
14	13	12	11	10	9	8

Q535

B	C
20:00~23:59 0.7 V	0 V

Q536

C
20:00~23:59 0V

Q533 (B)

Memory 0.7V

Q534

E	C
14.5 V	Memory 14V

Q203

E	FM	N	14V
C			13V
B	FM	N	12.5V

Q202

E	N	0.3V
C	N	10V
B	N	0.9V

Q204

C	FM	N	0V
B	FM	N	0.7V

Q415,416,417,418

Lamp ON	B	0.7V
	C	5V

Q403

1	2	3	4	5	6
0V	0V	0V	1.2 V	1.2 V	0 V
		0 V	12.5 V	14 V	0 V
		14	13~9	8	7

Q523

E		0V
C	Tuner	0V
B	Clock	0V
	Tuner	0.7V

Q201

1	2	3	4
9V	5 V	0.35V	0 V
	3 V	3 V	1.1V
	7	6	5

Q301

1	2	3	4	5	6	7	8	9
13.5V	3.2V	5.3V	7.3V	12V	12V	7.3V	0 V	Mono 13V St 0V
FM Auto 3.2V FM,AM Mono 0V			1.9V	2.5V	2.4V	FM 0V AM 13V	2.3V	2.3V
16			15	14	13	12	11	10

Q402

1	2	3	4	5
1.1V	3.4V	1.2V	6.8V	0 V
	0 V	0 V	0V	1.9V
	9	8	7	6

Q207

	E		C		B	
FM	Auto	2V	Auto	2.1V	Auto	1.5 V
	Mono	5 V	Mono	0 V	Mono	13.5 V
AM		5V		0 V		13.5 V

Q206

1	2	3	4	5	6	7
2.1V	2.1V	2.1V	0 V	FM Auto 2.1V FM Mono 0V AM 0V	5.5V	5.3V
1V	FM 0V AM 9V	0 V	0.4V	5 V	14V	5.8V
16	15	14	13	12	11	10,9,8

Q205

1	2	3	4	5	6
11.6V	10.8V	0.9V	0 V	1.6V	3.8V
					3.8V
					7

FM	AM
76~90MHz	522~1710KHz
3.2 - 21V	0.9 - 25V

Figure 20

Q101

1	5.2V	20	2.8V
2	2.1V	19	5.6V
3	2.5V	18	5.6V
4	0V	17	1.7V
5	11.2V	16	0V
6	2.0V	15	1.6V
7	12.0V	14	12.5V
8	12.0V	13	8V
9	2.7V	12	
10	8.5V	11	0.65V

Q404

	C	B	E
Auto	0V	0.7V	0V
Mono	14V	0V	0V

Q405

	C	B	E
Auto	0.7V	0V	0V
Mono	0V	0.6V	0V

Q406

	C	B	E
Auto	0V	0.7V	0V
Mono	15V	0V	0V

Q407

	C	B	E
Auto	13V	14.5V	14V
Mono	0V	12.5V	0V

Q408

	C	B	E
FM	0V	0.7V	0V
AM	13V	0V	0V

Q409

	C	B	E
FM	14V		14.5V
AM	0V		14.5V

Q410

	C	B	E
FM	13V	0V	0V
AM	0V	0.7V	0V

Q411

	C	B	E
FM	0V		14.5V
AM	14V		14.5V

Q412

	C	B	E
AM	14V	13.5V	14V

Q413

	C	B	E
FM	14V	13.5V	14V

Q501

1		2.7V
2	0.3V	
3		
4		
5		
6		
7		0.8V
8	Key Switch on Any one 0,3V	
9		
10		
11		
12	CH Indication Any one 0V	
13		
14		
15		
16	CH Indication Any one 5V	
17		
18		
19		2V
20		2V
21		5V
22		2.3V
23		0V
24		——
25		5.2V
26		——
27		4.5V
28		0.3V
29		5V
30		5V
31		4.7V
32	Muting 5V	0V
33		——
34	AM	4.4V
35	FM	4.4V
36		——
37		——
38		——
39		——
40	After 20:00 Oclock	5V
41	Clock	5V
42	Memory	5V

6. SCHEMATIC DIAGRAM

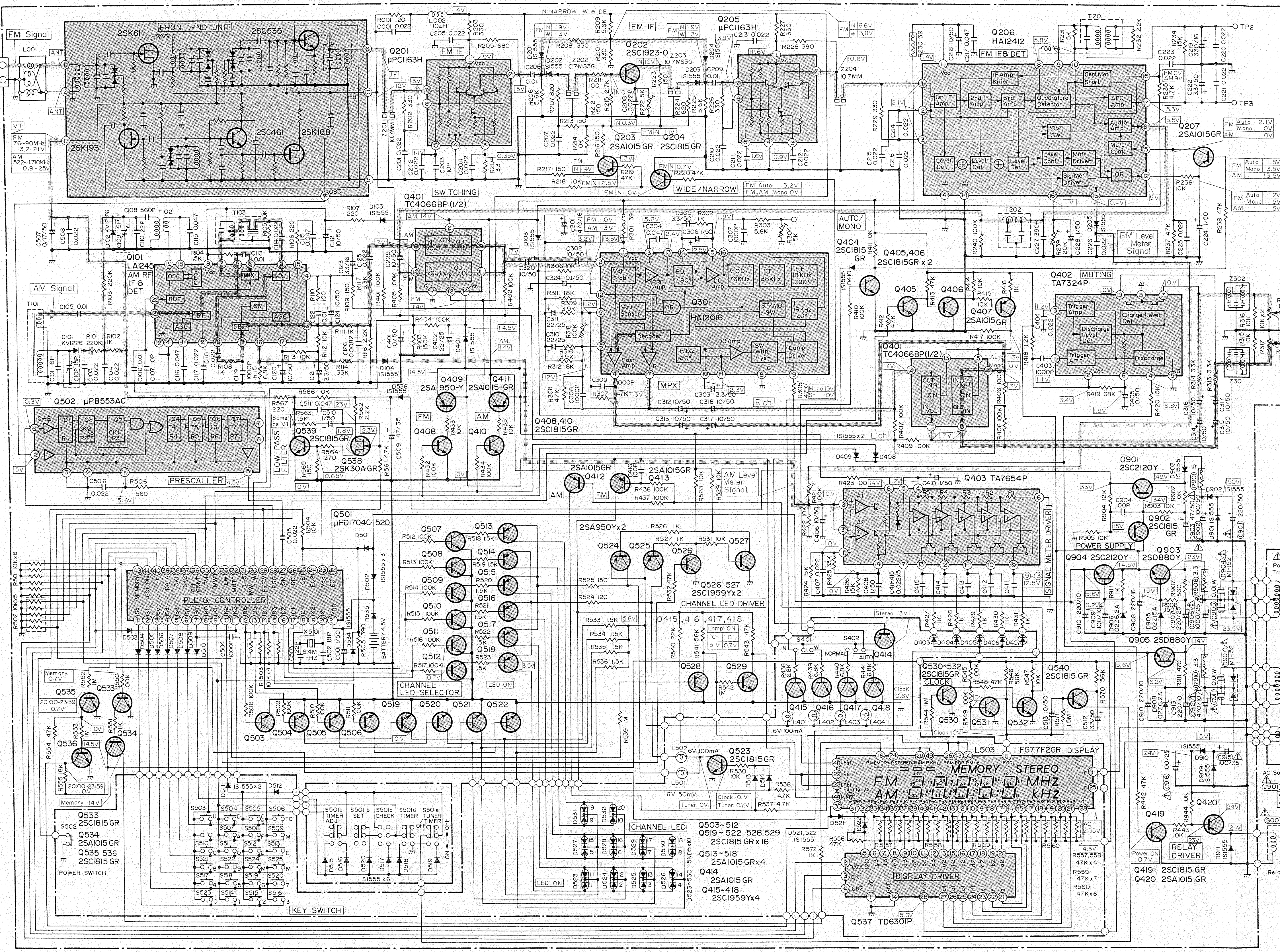

FM Signal
J101 FM Antenna Terminal
75ohm
FRONT END UNIT
2SK61
2SC535
2SC461
2SK168
2SK193
VT FM 76~90MHz 3.2~21V AM 522~1710KHz 0.9~25V
AM Signal
Q101 LA1245 AM RF IF & DET
OSC
BUF
MIX
RF
AGC
SM
DET
Q502 μPB553AC
PRESCALLER
Q201 μPC1163H
FM IF
N:NARROW W:WIDE
Q202 2SC1923-O
Q203 2SA1015GR
Q204 2SC1815GR
Q205 μPC1163H
WIDE/NARROW
Q206 HA12412
FM IF & DET
IF Amp Killer
1st IF Amp
2nd IF Amp
3rd IF Amp
Quadrature Detector
AFC Amp
Cent Met Short
Audio Amp
"OV" SW
Mute Cont
Mute Driver
Level Det
Level Cont
Sig Met Driver
OR
Q207 2SA1015GR
TP2
TP3
Q401 TC4066BP (1/2)
SWITCHING
Q301 HA12016
MPX
Volt Stabi
Pre Amp
P.D.1 ∠90°
DC Amp
V.C.O 76KHz
F.F 38KHz
F.F 19KHz ∠90°
F.F 19KHz ∠0°
Volt Senser
Decoder
ST/MO SW
Post Amp
P.D.2 ∠0°
SW With Hyst
Lamp Driver
AUTO/MONO
Q404 2SC1815GR
Q405,406 2SC1815GR x 2
Q407 2SA1015GR
Q402 TA7324P
MUTING
Trigger Amp
Charge Level Det
Discharge Level Det
Discharge
OUTPUT
Rch
Lch
FM Level Meter Signal
Q409 2SA950-Y
Q411 2SA1015-GR
Q408,410 2SC1815GR
LOW-PASS FILTER
Q539 2SC1815GR
Q538 2SK30AGR
Q412 2SA1015GR
Q413 2SA1015GR
AM Level Meter Signal
Q403 TA7654P
SIGNAL METER DRIVER
Q501 μPD1704C-520
PLL & CONTROLLER
BATTERY 4.5V
Q507 Q508 Q509 Q510 Q511 Q512
Q513 Q514 Q515 Q516 Q517 Q518
CHANNEL LED SELECTOR
Q519 Q520 Q521 Q522
Q503 Q504 Q505 Q506
Q524 Q525 Q526 Q527
2SA950Yx2
Q526 527 2SC1959Yx2
CHANNEL LED DRIVER
Q415,416 417,418
Q528 Q529
S401 S402 NORMAL AUTO
Q414
Q415 Q416 Q417 Q418
Q530~532 2SC1815GR CLOCK
Q530 Q531 Q532
Q540 2SC1815 GR
Q535 Q533 Q534 Q536
Memory 0.7V
20:00~23:59 0.7V
Q533 2SC1815GR
Q534 2SA1015GR
Q535 536 2SC1815GR
POWER SWITCH
S502
KEY SWITCH
S501a TIMER ADJ
S501b SET
S501c CHECK
S501d TIMER
S501e TUNER /TIMER OFF
Q523 2SC1815GR
CHANNEL LED
Q503~512 Q519~522 528,529 2SC1815GRx16
Q513~518 2SA1015GRx4
Q414 2SA1015GR
Q415~418 2SC1959Yx4
LED ON
L503 FG77F2GR DISPLAY
MEMORY STEREO
FM MHz
AM KHz
DISPLAY DRIVER
Q537 TD6301P
Q901 2SC2120Y
Q902 2SC1815 GR
Q903 2SD880Y
Q904 2SC2120Y
Q905 2SD880Y
POWER SUPPLY
T901 Power Transformer
Q419 Q420
RELAY DRIVER
Q419 2SC1815 GR
Q420 2SA1015 GR
AC Socket
Relay
EP01 Power Cord
AC220V 50Hz

Figure 21

Q101

1	5.2V	20	2.8V
2	2.1V	19	5.6V
3	2.5V	18	5.6V
4	0V	17	1.7V
5	11.2V	16	0V
6	2.0V	15	1.6V
7	12.0V	14	12.5V
8	12.0V	13	8V
9	2.7V	12	
10	8.5V	11	0.65V

Q404

	C	B	E
Auto	0V	0.7V	0V
Mono	14V	0V	0V

Q405

	C	B	E
Auto	0.7V	0V	0V
Mono	0V	0.6V	0V

Q406

	C	B	E
Auto	0V	0.7V	0V
Mono	15V	0V	0V

Q407

	C	B	E
Auto	13V	14.5V	14V
Mono	0V	12.5V	0V

Q408

	C	B	E
FM	0V	0.7V	0V
AM	13V	0V	0V

Q409

	C	B	E
FM	14V		14.5V
AM	0V		14.5V

Q410

	C	B	E
FM	13V	0V	0V
AM	0V	0.7V	0V

Q411

	C	B	E
FM	0V		14.5V
AM	14V		14.5V

Q412

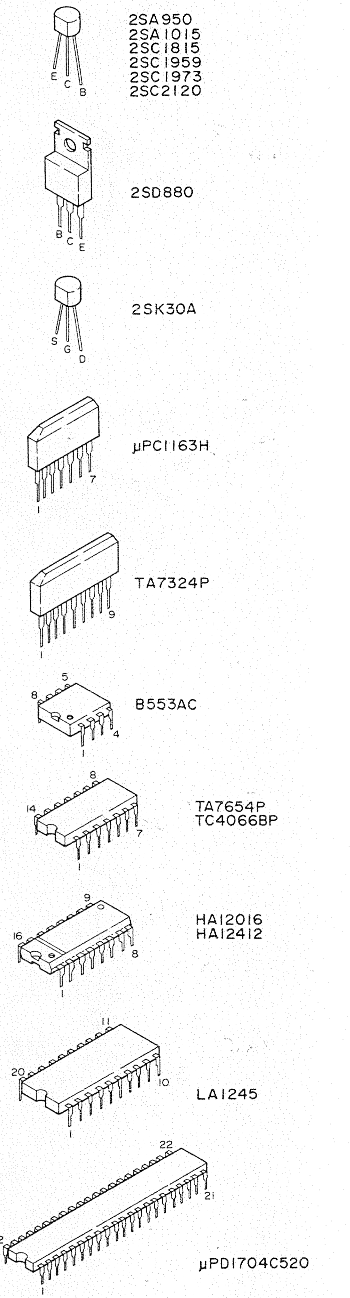
	C	B	E
AM	14V	13.5V	14V

Q413

	C	B	E
FM	14V	13.5V	14V

Q501

1		2.7V
2		0.3V
3		
4		
5		
6		
7		0.8V
8	Key Switch on Any one	0.3V
9		
10		
11		
12	CH Indication Any one	0V
13		
14		
15		
16	CH Indication Any one	5V
17		
18		
19		2V
20		2V
21		5V
22		2.3V
23		0V
24		—
25		5.2V
26		—
27		4.5V
28		0.3V
29		5V
30		5V
31		4.7V
32	Muting 5V	0V
33		—
34	AM	4.4V
35	FM	4.4V
36		—
37		—
38		—
39		—
40	After 20:00 Oclock	5V
41	Clock	5V
42	Memory	5V


2SA950
2SA1015
2SC1815
2SC1959
2SC1973
2SC2120
E C B
2SD880
B C E
2SK30A
S G D
μPC1163H
TA7324P
B553AC
TA7654P
TC4066BP
HA12016
HA12412
LA1245
μPD1704C520
1
5
7
8
9
10
11
14
16
20
21
22
42

NOTE:

		Position
S001:	Relay Switch	OFF
S401:	WIDE/NARROW Switch	WIDE
S402:	MONO/AUTO Switch	AUTO
S501a:	TIMER ADJ. Switch	OFF
S501b:	TIMER SET Switch.	OFF
S501c:	TIMER CHECK Switch	OFF
S501d:	TIMER Switch	OFF
S501e:	TUNER/TIMER OFF Switch	ON
S502:	POWER Switch	OFF
S503:	FREQUENCY UP Switch	OFF
S504:	FREQUENCY DOWN Switch	OFF
S505:	CHANNEL SCAN Switch	OFF
S506:	TIME CALL Switch	OFF
S507:	AM Switch	OFF
S508:	FM Switch.	OFF
S509:	MEMORY Switch	OFF
S510:	ONCE OFF Switch	OFF
S511:	ONCE ON Switch	OFF
S512:	EVERY DAY OFF Switch	OFF
S513:	EVERY DAY ON Switch	OFF
S514:	CH1 Switch.	OFF
≀	≀	≀
S522:	CH9 Switch.	OFF
S523:	CH0 Switch.	OFF
S524:	CHA Switch	OFF
S525:	CHB Switch.	OFF

CAUTION:
The ⚠ mark, the symbol No. circled with rectangle in the schematic diagram and the shaded area in the parts list designate components which have special characteristics important for safety and should be replace only with types identical to those in the original circuit or specified in the parts list.

7. EXPLODED VIEW CABINET

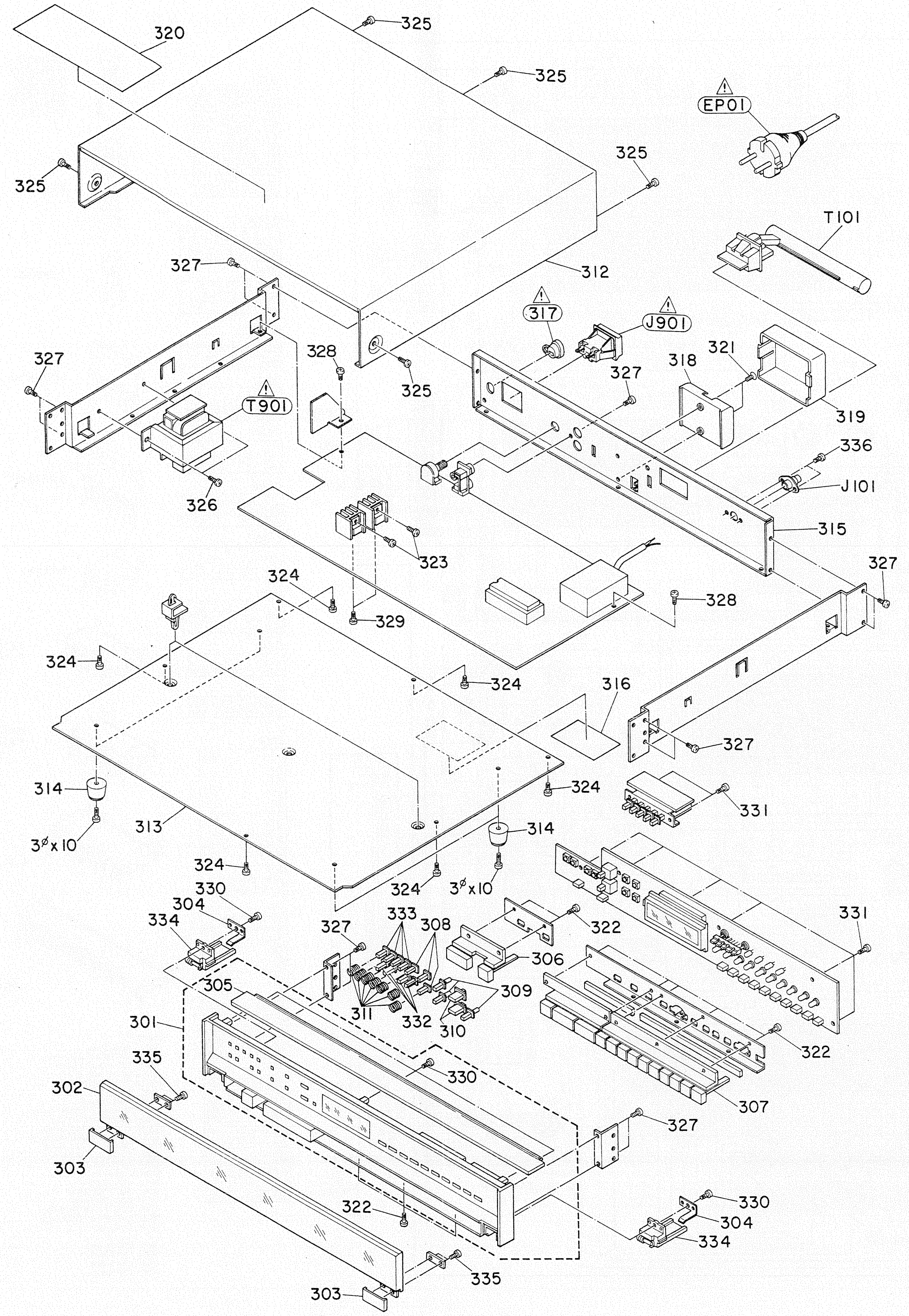

320
325
325
EP01
325
325
T101
327
312
317
J901
327
321
318
328
327
325
T901
319
336
J101
326
315
323
327
324
328
329
324
324
316
327
314
324
331
3φx10
313
314
324
330
324
3φx10
304
334
327
333
308
322
331
306
305
309
301
311
332
310
322
335
330
302
307
327
303
330
322
304
334
335
303

Figure 23

NOTE: Parts excluded in the parts list are not available as replacement parts.

8. CABINET PARTS LIST

Symbol No.	Part No.	Description
301	22825109	Front Panel Ass'y
302	22837454	Front Cover
303	22826388	Hinge Ass'y, Front Cover
304	25779311	Spring, Hinge
305	22838180	Top Decoration Plate
306	22826398	Knob Ass'y, POWER/TIME CALL
307	22826386	Knob Ass'y, Channel
308	22884256	Knob, AUTO/WIDE/TIME-OFF
309	22884257	Knob, FM/AM/MEMORY
310	22884258	Knob, TUNING-UP/TUNING-DOWN
311	25777154	Spring, Knob
312	22841328	Top Cover
313	22714193	Bottom Plate
314	22874041	Foot
315	22714194	Jack Plate
316	22864437	Name Label
⚠ 317	25845528	Cord Bush
318	22882007	Battery Box
319	22832576	Battery Cover
320	22906381	Caution Label
321	22707626	Screw, FLT Tapping, 2.6φ x 8mm, BLK
322	22707929	Screw, BID Tapping, 2.6φ x 10mm, BLK
323	22707066	Screw, BID, 3φ x 6mm
324	22701237	Screw, BID Tapping, 3φ x 6mm, BLK
325	22707543	Screw, BID Tapping, 3φ x 8mm
326	22707521	Screw, FLDT, 3φ x 6mm, BLK
327	22701326	Screw, BID Tapping, 3φ x 8mm
328	22707115	Screw, BID Tapping, 3φ x 8mm
329	22707327	Screw, Chrome, 3φ x 8mm
330	22707165	Screw, BID Tapping, 3φ x 10mm
331	22707116	Screw, BID Tapping, 3φ x 10mm
332	22884283	Knob, ONCE ON-OFF/EVERYDAY ON-OFF
333	22884284	Knob, TIMER/TIMER-ADJ/TIMER-SET/CHECK
334	22883025	Hinge, Front Cover
335	22701411	Screw, BID, 2φ x 4mm
336	22707397	Screw, DTBID, 2.6φ x 5mm

Symbol No.	Part No.	Description

9. PARTS LIST

CAUTION:
The ⚠ mark, the symbol No. circled with rectangle in the schematic diagram and the shaded area in the parts list designate components which have special characteristics important for safety and should be replace only with types identical to those in the original circuit or specified in the parts list.

Symbol No.	Part No.	Description
TRANSISTORS, ICS & DIODES		
Q101	22114939	IC, LA1245
Q201	22117070	IC, μPC1163H
Q202	A6319020	Transistor, 2SC1923-O
Q203	A6534060	Transistor, 2SA1015-GR
Q204	A6317460	Transistor, 2SC1815NEW-GR
Q205	22117070	IC, μPC1163H
Q206	22114864	IC, HA12412
Q207	A6534060	Transistor, 2SA1015-GR
Q301	22114837	IC, HA12016
Q401	B0470662	IC, TC4066BP
Q402	B0325060	IC, TA7324P
Q403	B0356540	IC, TA7654P
Q404, 405, 406	A6317460	Transistor, 2SC1815NEW-GR
Q407	A6534060	Transistor, 2SA1015-GR
Q408	A6317460	Transistor, 2SC1815NEW-GR
Q409	A6532940	Transistor, 2SA950-Y
Q410	A6317460	Transistor, 2SC1815NEW-GR
Q411, 412, 413, 414	A6534060	Transistor, 2SA1015-GR
Q415, 416, 417, 418	A6319300	Transistor, 2SC1959NEW-Y
Q419	A6317460	Transistor, 2SC1815NEW-GR
Q420	A6534060	Transistor, 2SA1015-GR
Q501	22114948	IC, μPD1704C-520
Q502	22114947	IC, μPB553AC
Q503, 504, 505, 506, 507, 508, 509, 510, 511, 512	A6317460	Transistor, 2SC1815NEW-GR
Q513, 514, 515, 516, 517, 518	A6534060	Transistor, 2SA1015-GR
Q519, 520, 521, 522, 523	A6317460	Transistor, 2SC1815NEW-GR
Q524, 525	A6532940	Transistor, 2SA950-Y
Q526, 527	A6319300	Transistor, 2SC1959NEW-Y
Q528, 529, 530, 531, 532, 533	A6317460	Transistor, 2SC1815NEW-GR
Q534	A6534060	Transistor, 2SA1015-GR
Q535, 536	A6317460	Transistor, 2SC1815NEW-GR
Q537	B0272005	IC, TD6301AP
Q538	A6048370	Transistor, 2SK30A-TM. GR
Q539, 540	A6317460	Transistor, 2SC1815NEW-GR
Q901, 904	A6321240	Transistor, 2SC2120-Y/GR
Q902	A6317460	Transistor, 2SC1815NEW-GR
Q903, 905	A6848520	Transistor, 2SD880-Y-Y/GR
D101, 102	22115599	Diode, KV1226
D103, 104	A7246703	Diode, 1S1555V
D201, 202, 203, 204, 205	A7246703	Diode, 1S1555V
D401, 402	A7246703	Diode, 1S1555V
D403, 404, 405, 406, 407	A8606661	Diode, TLG208-5
D408, 409, 410	A7246703	Diode, 1S1555V
D501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522	A7246703	Diode, 1S1555V
D523, 524, 525, 526, 527, 528, 529, 530, 531, 532	22115789	Diode, GL-5ND5
D535, 536	A7246703	Diode, 1S1555V

Symbol No.	Part No.	Description
D901, 902, 903	A7246703	Diode, 1S1555V
⚠ D904	22115427	Diode, MI-152
D905	A7287900	Diode, 02Z15A
D906	A7286100	Diode, 02Z6.2A
⚠ D907	22115427	Diode, MI-152
D908	A7286100	Diode, 02Z6.2A
D909, 910, 911, 912	A7246703	Diode, 1S1555V

ELECTRICAL PARTS

Symbol No.	Part No.	Description
L001	22290013	Coil, Balun
L002	22241013	Coil, Choke, 10 μH
L401, 402, 403, 404	22113589	Lamp, 6V, 10mA, BLU
L501	22113587	Lamp, 6V, 50mA, RED
L502	22113588	Lamp, 6V, 100mA, GRN
L503	22104581	Display Tube, FG77F2GR
T101	22242800	Coil, AM Antenna
T102	22245419	Coil, AM Oscillator
T103	22153154	Filter, Ceramic, 450 kHz, AM
T201	22267424	IF Transformer, FM
T202	22153193	Filter, FTZ
⚠ T901	22224146	Transformer, Power
Z001	22131370	FM Front End Unit
Z201, 204	22153091	Filter, Ceramic, 10.7 MHz, FM
Z202, 203	22153124	Filter, Ceramic, 10.7 MHz, FM
Z301, 302	22212058	Coil, Low-pass Filter
X501	22153185	Crystal, 4.5 MHz
⚠ S001	22148682	Relay, Power ON-OFF
S401	22196091	Switch, Push, WIDE/NARROW
S402	22196091	Switch, Push, MONO/AUTO
S501-a,	22196092	Switch, Push, TIMER ADJ.
501-b,		Switch, Push, SET
501-c,		Switch, Push CHECK
501-d,		Switch, Push TIMER
501-e		Switch, Push, TIMER OFF
S502	22196090	Switch, Key, POWER
S503	22195924	Switch, Key, FREQUENCY UP
S504	22195924	Switch, Key, FREQUENCY DOWN
S505	22196090	Switch, Key, CHANNEL SCAN
S506	22196090	Switch, Key, TIME CALL
S507,	22195924	Switch, Key, AM
508,		Switch, Key, FM
509,		Switch, Key, MEMORY
510,		Switch, Key, ONCE OFF
511,		Switch, Key, ONCE ON
512,		Switch, Key, EVERYDAY OFF
513		Switch, Key, EVERYDAY ON
S514,	22196090	Switch, Key, CH1
515,		Switch, Key, CH2
516,		Switch, Key, CH3
517,		Switch, Key, CH4
518,		Switch, Key, CH5
519,		Switch, Key, CH6
520,		Switch, Key, CH7
521,		Switch, Key, CH8
522,		Switch, Key, CH9
523,		Switch, Key, CH0
524,		Switch, Key, CHA
525		Switch, Key, CHB
J001	22163821	Jack, US2P, OUTPUT
J101	22162492	Terminal, Antenna
⚠ J901	22169002	AC Socket, 2P
⚠ EP01	22176571	Cord, Power

CAPACITORS

D = ±0.5pF, G = ±2%, J = ±5%, K = ±10%, Z = –20+80%
ABBREVIATION: CD = Ceramic Disk, EL = Electrolytic
PP = Polypropylene, MY = Mylar

Symbol No.	Part No.	Description
C001	22342223	CD, 0.022mfd, 50V, Z
C101	22361609	CD, 6pF, 50V, D
C102	22309155	Trimmer, Max. 20pF x 2
C103, 104	22342223	CD, 0.022mfd, 50V, Z
C105, 106	22342103	CD, 0.01mfd, 50V, Z
C107	22361100	CD, 10pF, 50V, D
C108	22321223	PP, 560pF, 50V, G
C109	22309155	Trimmer, Max. 20pF x 2
C110	22362220	CD, 22pF, 50V, K
C111	22342473	CD, 0.047mfd, 50V, Z
C112	22488100	EL, 10mfd, 50V

Symbol No.	Part No.	Description
C113	22342103	CD, 0.01mfd, 50V, Z
C114	22342223	CD, 0.022mfd, 50V, Z
C115, 116	22342473	CD, 0.047mfd, 50V, Z
C117, 118	22342223	CD, 0.022mfd, 50V, Z
C119	22349102	CD, 1000pF, 50V, K
C120	22488100	EL, 10mfd, 50V
C121	22488339	EL, 3.3mfd, 50V
C122	22342103	CD, 0.01mfd, 50V, Z
C123	22485330	EL, 33mfd, 16V
C124	22488100	EL, 10mfd, 50V
C125	22342223	CD, 0.022mfd, 50V, Z
C126	22372822	MY, 0.0082mfd, 50V, K
C201, 202	22342223	CD, 0.022mfd, 50V, Z
C203	22361100	CD, 10pF, 50V, D
C204, 205	22342223	CD, 0.022mfd, 50V, Z
C206	22342103	CD, 0.01mfd, 50V, Z
C207, 208	22342223	CD, 0.022mfd, 50V, Z
C209	22342103	CD, 0.01mfd, 50V, Z
C210, 211	22342223	CD, 0.022mfd, 50V, Z
C212, 213	22342223	CD, 0.022mfd, 50V, Z
C214, 215	22342223	CD, 0.022mfd, 50V, Z
C216	22342223	CD, 0.022mfd, 50V, Z
C217	22342473	CD, 0.047mfd, 50V Z
C218	22488100	EL, 10mfd, 50V
C219	22485331	EL, 330mfd, 16V
C220, 221	22342223	CD, 0.022mfd, 50V, Z
C222	22488339	EL, 3.3mfd, 50V
C223	22342223	CD, 0.022mfd, 50V, Z
C224	22488109	EL, 1mfd, 50V
C225, 226	22342223	CD, 0.022mfd, 50V, Z
C227	22349391	CD, 390pF, 50V, K
C228	22488109	EL, 1mfd, 50V
C229	22488100	EL, 10mfd, 50V
C301	22485471	EL, 470mfd, 16V
C302	22488100	EL, 10mfd, 50V
C303	22488339	EL, 3.3mfd, 50V
C304	22372473	MY, 0.047mfd, 50V, K
C305	22488339	EL, 3.3mfd, 50V
C306	22488109	EL, 1mfd, 50V
C307	22321057	PP, 1000pF, 50V, J
C308, 309	22321057	PP, 1000pF, 50V, J
C310, 311	22486220	EL, 22mfd, 25V
C312, 313	22488100	EL, 10mfd, 50V
C314, 315	22488100	EL, 10mfd, 50V
C316, 317	22488100	EL, 10mfd, 50V
C318, 319	22488100	EL, 10mfd, 50V
C320	22488100	EL, 10mfd, 50V
C324	22488108	EL, 0.1mfd, 50V

Symbol No.	Part No.	Description
C401	22488100	EL, 10mfd, 50V
C402	22486220	EL, 22mfd, 25V
C403	22349102	CD, 1000pF, 50V, K
C404	22342223	CD, 0.022mfd, 50V, Z
C405, 406	22488100	EL, 10mfd, 50V
C407	22342223	CD, 0.022mfd, 50V, Z
C408	22488109	EL, 1mfd, 50V
C410	22488109	EL, 1mfd, 50V
C411, 412	22342223	CD, 0.022mfd, 50V, Z
C413, 414	22342223	CD, 0.022mfd, 50V, Z
C415	22342223	CD, 0.022mfd, 50V, Z
C416	22362101	CD, 100pF, 50V, K
C501	22488109	EL, 1mfd, 50V
C502	22362180	CD, 18pF, 50V, K
C503	22362220	CD, 22pF, 50V, K
C504	22349102	CD, 1000pF, 50V, K
C505, 506	22342223	CD, 0.022mfd, 50V, Z
C507	22488478	EL, 0.47mfd, 50V
C508	22342223	CD, 0.022mfd, 50V, Z
C509	22487470	EL, 47mfd, 35V
C510	22488109	EL, 1mfd, 50V
C511	22372473	MY, 0.047mfd, 50V, K
C512	22488339	EL, 3.3mfd, 50V
C513	22488100	EL, 10mfd, 50V
⚠ C901	22488221	EL, 220mfd, 50V
⚠ C902	22488101	EL, 100mfd, 50V
C903	22488470	EL, 47mfd, 50V
C904	22362101	CD, 100pF, 50V, K
⚠ C905	22340148	CD, 0.01mfd, 500V x 2
⚠ C906	22486102	EL, 1000mfd, 25V
C907	22486221	EL, 220mfd, 25V
C908	22485221	EL, 220mfd, 16V
C909	22483101	EL, 100mfd, 10V
C910	22483221	EL, 220mfd, 10V
⚠ C911	22340148	CD, 0.01mfd, 500V x 2
⚠ C912	22485471	EL, 470mfd, 16V
C913	22483221	EL, 220mfd, 10V
C914	22483331	EL, 330mfd, 10V
⚠ C915	22487101	EL, 100mfd, 35V
⚠ C916	22486101	EL, 100mfd, 25V

RESISTORS

Resistors are carbon film 1/4W, ±5%, unless otherwise noted. 1K = 1000, 1M = 1000K

Symbol No.	Part No.	Description
R001	22545121	120 ohm
R101	22545224	220K ohm
R102	22545102	1K ohm
R103	22545224	220K ohm
R104	22545152	1.5K ohm
R105	22555103	10K ohm
R106, 107	22545221	220 ohm
R108	22545102	1K ohm
R109	22545151	150 ohm
R110	22545101	100 ohm
R111	22545102	1K ohm
R112, 113	22545103	10K ohm
R114	22545273	27K ohm
R115	22545682	6.8K ohm
R116	22545222	2.2K ohm
R117	22545332	3.3K ohm
R202, 203	22545331	330 ohm
R204	22545330	33 ohm
R205	22545681	680 ohm
R206	22545562	5.6K ohm
R207	22545821	820 ohm
R208	22545331	330 ohm
R209	22545562	5.6K ohm
R210	22545331	330 ohm
R211	22545101	100 ohm
R212, 213	22545151	150 ohm
R214	22545103	10K ohm
R215	22545272	2.7K ohm
R216, 217	22545151	150 ohm
R218	22545103	10K ohm
R219, 220	22545473	47K ohm
R222	22658513	5K ohm, Semi-fixed Variable
R223	22545151	150 ohm
R224	22545821	820 ohm
R225	22545562	5.6K ohm
R226, 227	22545331	330 ohm
R228	22545391	390 ohm
R229	22545331	330 ohm
⚠ R230	22500178	39 ohm, Fusible
R231	22545153	15K ohm
R232	22545222	2.2K ohm
R234	22545153	15K ohm
R235	22545472	4.7K ohm
R236	22545103	10K ohm
R237, 238	22545473	47K ohm
R239	22658493	20K ohm, Semi-fixed Variable
R240	22545104	100K ohm
⚠ R301	22500178	39 ohm, Fusible
R302	22545102	1K ohm
R303	22545562	5.6K ohm
R304	22658513	5K ohm, Semi-fixed Variable
R305	22545473	47K ohm
R306	22545103	10K ohm
R307, 308	22545473	47K ohm
R309, 310	22545392	3.9K ohm
R311, 312	22545183	18K ohm
R313, 314	22545332	3.3K ohm
R315, 316	22545103	10K ohm
R317	22622426	10K, B, Variable, Output
R318	22658495	100K ohm, Semi-fixed Variable
R319, 320	22545102	1K ohm
R401, 402	22545104	100K ohm
R403	22545154	150K ohm
R404, 405	22545104	100K ohm
R406, 407	22545104	100K ohm
R408, 409	22545104	100K ohm
R410	22545104	100K ohm
R411	22545103	10K ohm
R412, 413	22545473	47K ohm
R414, 415	22545103	10K ohm
R416	22545102	1K ohm
R417	22545104	100K ohm
R418	22545122	1.2K ohm
R419	22545683	68K ohm
R420	22545103	10K ohm
R421	22658495	100K ohm, Semi-fixed Variable
R422	22545103	10K ohm
R423	22545221	220 ohm
R424	22545153	15K ohm
R425	22545333	33K ohm
R426	22545153	15K ohm
R427, 428	22545102	1K ohm
R429, 430	22545102	1K ohm
R431	22545102	1K ohm
R432	22545104	100K ohm
R433	22545103	10K ohm
R434	22545104	100K ohm
R435	22545103	10K ohm
R436, 437	22545104	100K ohm
R438, 439	22545682	6.8K ohm
R440, 441	22545682	6.8K ohm
R442	22545473	47K ohm
R443, 444	22545103	10K ohm

Symbol No.	Part No.	Description
R501	22540591	Composite Part, 10K ohm x 6
R502	22540591	Composite Part, 10K ohm x 5
R503	22540592	Composite Part, 10K ohm x 4
R504	22545103	10K ohm
R505	22545391	390 ohm
R506	22545561	560 ohm
R508, 509	22545104	100K ohm
R510, 511	22545104	100K ohm
R512, 513	22545104	100K ohm
R514, 515	22545104	100K ohm
R516, 517	22545104	100K ohm
R518, 519	22545152	1.5K ohm
R520, 521	22545152	1.5K ohm
R522, 523	22545152	1.5K ohm
R524	22545121	120 ohm
R525	22545151	150 ohm
R526, 527	22545102	1K ohm
R528, 529	22545103	10K ohm
R530, 531	22545103	10K ohm
R532	22545473	47K ohm
R533, 534	22545152	1.5K ohm
R535, 536	22545152	1.5K ohm
R537, 538	22545472	4.7K ohm
R539	22545105	1M ohm
R540	22545223	22K ohm
R541	22545563	56K ohm
R542	22545105	1M ohm
R543	22545473	47K ohm
R544	22545105	1M ohm
R545	22545104	100K ohm
R546	22545563	56K ohm
R547	22545103	10K ohm
R548	22545473	47K ohm
R549, 550	22545104	100K ohm
R551	22545102	1K ohm
R552, 553	22545105	1M ohm
R554	22545473	47K ohm
R555	22545183	18K ohm
R556	22545473	47K ohm
R557, 558	22540593	Composite Part, 47K ohm x 4
R559	22540550	Composite Part, 47K ohm x 7
R560	22540550	Composite Part, 47K ohm x 6
R561	22545472	4.7K ohm
R562	22545222	2.2K ohm
R563	22545152	1.5K ohm
R564	22545271	270 ohm

Symbol No.	Part No.	Description
R565	22545151	150 ohm
R566	22545103	10K ohm
R567	22545221	220 ohm
R570	22545563	56K ohm
R571	22545155	1.5M ohm
R572	22545102	1K ohm
⚠ R901	22500174	15 ohm, Fusible
R902, 903	22545103	10K ohm
R904	22545123	12K ohm
R905	22545103	10K ohm
⚠ R906	22500168	3.3 ohm, Fusible
R907	22545561	560 ohm
R908	22545151	150 ohm
R909	22545102	1K ohm
⚠ R910	22500168	3.3 ohm, Fusible
R911	22545471	470 ohm

ACCESSORIES

AC01	22903385	Owner's Manual
AC02	22164775	Joint Cord
AC03	22826397	Decoration Hinge Ass'y
AC04	22999268	Polystlyrene Bag (Hinge)